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ETHNOMATHEMATICS AND THE CURRICULUM OF TOMORROW: A FRAMEWORK FOR INCLUSIVE AND PROGRESSIVE EDUCATION

Anil Kumar*, Central University of Rajasthan, India
Seema Gopinath, Central University of Rajasthan, India
*e-mail: anil65664@gmail.com (corresponding author)

Abstract: Ethnomathematics, the study of the relationship between culture and mathematical practices, has gained prominence as an approach to fostering inclusivity in education. This research paper explores how ethnomathematics can be integrated into modern curricula to create a framework for inclusive and progressive education. It reviews existing literature, presents a theoretical foundation, details methodologies for studying ethnomathematical practices, and discusses case studies demonstrating successful implementation. The paper further develops a framework for curriculum integration, considers challenges and strategies for implementation, and provides insights into future directions for ethnomathematics in education. The growing need for culturally responsive and inclusive education requires a place for ethnomathematics in curricula. Developed from the foundation of Vygotsky's (1978) theory of constructivist learning, Ladson-Billings' (1995) culturally responsive pedagogy, and Lave and Wenger's (1991) situated learning theory, this research investigates the nexus of ethnomathematics and progressive education models. This research uses a qualitative research approach involving a systematic literature review according to PRISMA guidelines, document analysis, and comparative case studies. The literature review establishes the main advantages and difficulties of ethnomathematics integration, analyzing approaches to embedding ethnomathematical principles into curriculum development. This study proposed a universal framework for Ethnomathematics integration into the curriculum. Through this thorough approach, the research highlights the potential of ethnomathematics to revolutionize mathematics education as a more inclusive, relevant, and socially responsive subject.

Keywords: Ethnomathematics, inclusive curriculum, progressive education, ethnomathematics integration framework

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INTRODUCTION

In the world of today, which is fast-moving and rapidly changing, the impact of technological changes and globalization on human life has both positive and negative

impacts. While information and technological innovations have made the world more interconnected, improved communication, and made it easier to access information, they have also resulted in the breakdown of local traditions, cultural identity, and indigenous knowledge systems. One scholarly reaction to this challenge has been the creation of ethnomathematics, a study investigating the connection between mathematics and culture.

D'Ambrosio (1985) first proposed the idea of ethnomathematics, where he stressed that mathematical wisdom is not universal but is instead influenced by various cultural and historical backgrounds. This point of view has opened the door for various studies on how mathematical ideas are realized within diverse cultural activities. For instance, research has shown that mathematical concepts are firmly rooted in routine acts like weaving (Barton, 2008), traditional architecture (Eglash,1999), and native systems of counting (Gerdes, 2010).

Additionally, ethnomathematics research highlights possible educational advantages, such as encouraging student participation, enriching mathematical understanding, and enhancing cultural consciousness and appreciation (Rosa & Orey, 2013). Despite these benefits, the inclusion of ethnomathematics in traditional curricula is challenging. Institutional limitations, standard testing structures, and insufficient teacher training discourage the extensive use of ethnomathematical strategies in formal education systems (Knijnik, 1999). These challenges must be addressed through collective efforts from policymakers, researchers, and educators to create solutions that reconcile the retention of cultural heritage with contemporary needs in education.

METHOD

A qualitative research approach incorporates a Systematic literature review, document analysis, and Comparative case studies. Data collection methods include.

Systematic literature review

The conventional method of learning mathematics tends to adopt a universal, culture-free attitude. Ethnomathematics refutes this notion by embracing different mathematics practices in cultures (D'Ambrosio, 1985). As education systems around the globe aim to become more inclusive and equitable, ethnomathematics offers an approach to incorporating cultural insights into mathematics curricula.

This study systematically reviews the literature on ethnomathematics and its role in shaping future curricula. Employing the PRISMA methodology, this research aims to:

1. Identify existing literature on ethnomathematics in education.
2. Examine the benefits and challenges of integrating ethnomathematics.
3. Propose strategies for embedding ethnomathematical principles in curriculum design.

Methodology

This systematic literature review follows the PRISMA guidelines to ensure transparency and rigor. The process involves four key phases: Identification, Screening, Eligibility, and Inclusion.

Search Strategy

A comprehensive search was conducted across Google Scholar, ERIC, and Shodh Ganga databases. The search terms included:

a. Ethnomathematics and education
b. Culturally responsive mathematics curriculum
c. Indigenous mathematical practices in education
d. Mathematics education reform and inclusivity

Inclusion and Exclusion Criteria

Inclusion	:	Peer-reviewed journal articles, books, and conference proceedings (2014-2024) focusing on ethnomathematics and curriculum development.
Exclusion	:	Studies unrelated to formal education, non-peer-reviewed sources, language, and articles lacking empirical or theoretical contributions.

PRISMA Flow Diagram

Following PRISMA, a structured flow diagram was developed:

Identification	:	269 articles retrieved from databases.
Screening	:	212 duplicates and irrelevant studies removed.
Eligibility	:	57 full-text articles assessed.
Inclusion	:	23 studies were included for final synthesis.

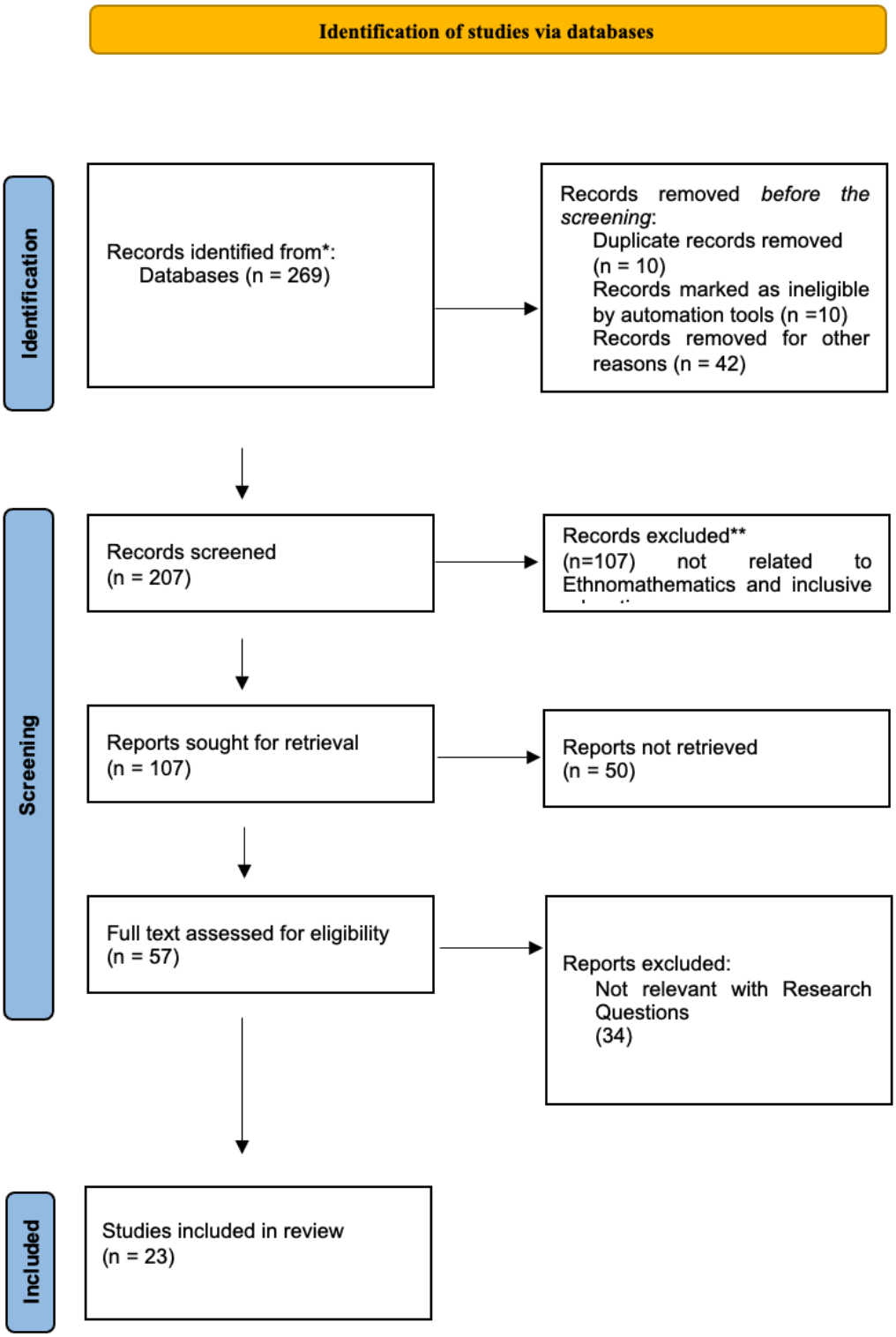

Figure 1. PRISMA protocol flowchart

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Chart is a systematic flow diagram that records the process of identifying and screening sequentially and including studies in a research study (Figure 1).

RESULTS AND DISCUSSION

Analysis of studies included in the Review

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
Teachers' perception toward the use of the ethnomathematics approach in teaching math	Mania & Alam (2021)	The current research offers imperative empirical evidence affirming the integration of ethnomathematics into curricula to come. The research aligns with the argument that educational progress and inclusion must be grounded in cultural mathematics to make schooling more relevant, meaningful, and equitable. At the same time, it highlights the pedagogical and structural issues that need to be addressed through teacher education, curriculum reform, and institutional transformation. In summary, Mania & Alam (2021) emphasize the significance of ethnomathematics in consolidating cultural wisdom and formal schooling but stress further the importance of systemic modifications so that its viable implementation will become a success within classrooms.
Development of mathematical thinking through integration of ethnomathematic folklore game in math instruction	Fouze & Amit (2017)	This research is a direct reflection of the vision of a progressive and inclusive mathematics curriculum that respects multiple forms of cultural knowledge. In highlighting the incorporation of ethnomathematics in formal education, it reinforces the contention that future curricula must transcend Eurocentric mathematical frameworks to incorporate culturally diverse pedagogies. The study highlights the imperative of developing an inclusive and student-centered curriculum that is responsive to the students' cultural backgrounds, ensuring that mathematics becomes more accessible, interesting, and relevant for students from diverse communities. In addition, the study's findings inform the curriculum reform discourse by calling for the integration of ethnomathematical pedagogies into teacher education, policy development, and educational research. It provides a solid foundation for reframing conventional math teaching and developing a culturally responsive curriculum that enables students to thrive in an interconnected and diverse world.

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
A trivium curriculum for mathematics based on literacy, matheracy, and technoracy: An ethnomathematics perspective	Rosa & Orey (2015)	This study is pertinent to the future debate on future curricula development using ethnomathematics. It offers a model for inclusive education in which mathematical learning is not just computational but also technologically adaptive and culturally responsive. By incorporating literacy (being able to read and write mathematical language and representation), matheracy (problem-solving and critical mathematical reasoning), and technocracy (utilizing technology for learning mathematics), the study presents an innovative model for curriculum development. This is consistent with the aims of Ethnomathematics and Curriculum of Tomorrow in building a more inclusive, equitable, and future-prepared education system where diverse mathematical practices are valued, and learners are prepared to engage with international problems.
Integrating ethnomathematics into secondary school mathematics curriculum for effective artisan creative skill development	Ogunkunle & George (2015)	This research supplies sound empirical backing for the inclusion of ethnomathematics within contemporary curricula in order to foster practical, culture-specific mathematical skills. It concurs with Ethnomathematics and the Curriculum of Tomorrow's vision through showing how mathematical education can be refashioned into a context-sensitive, skills-based learning environment that promotes the creative problem-solving capabilities of learners and equips them for practice. In showing the importance of mathematics in craftsmanship skill acquisition, this study proposes a curriculum emphasizing local knowledge systems in which mathematics is more practical and accommodating for varied learners within an ever-changing society.
Ethnomathematics-based Pancasila student profile strengthening project module in the merdeka curriculum phase a in elementary schools	Amreta & Anisah (2023)	This research presents an applied and evidence-based model of incorporating ethnomathematics in early childhood teaching, reinforcing calls for culturally relevant pedagogy in curating the future curriculum. It conforms to the Ethnomathematics and the Curriculum of Tomorrow vision of showing that inserting local math practice into structured study modules is key to building students' critical thinking, creativity, and appreciation of culture.

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
		By verifying and testing the efficacy of ethnomathematics-informed learning, this study illustrates a scalable and flexible model for future curriculum design, promoting contextualized learning, interdisciplinarity, and inclusivity in mathematics education.
Development of android-based learning media for high school students in Indonesia: A systematic review of literature	Deda, Disnawati, Daniel, & Ekawati (2023)	This study concurs with the Ethnomathematics and Curriculum of Tomorrow vision by highlighting contextualized learning practices that connect classical mathematical knowledge with contemporary capacities. Ethnomathematics provides contextually appropriate approaches to literacy and numeracy development, especially in culturally heterogeneous learning environments. The incorporation of ethnomathematical practice into the curriculum may render mathematical principles more accessible and meaningful, thereby stimulating critical thinking and problem-solving in culturally responsive ways. This link suggests that future curricula should integrate indigenous knowledge systems with contemporary educational systems to develop a holistic, comprehensive, and future-oriented model of education.
Developing a common practice model for literacy & communication and maths: An overview of the literature	Gibbs, White, & McDowall (2022)	This study aligns with the ethnomathematics concept of emphasising the importance of a holistic and culturally sensitive approach to learning mathematics. The major connections are: - Interdisciplinary Learning - Contextualized Learning - Inclusive Pedagogies - Future-Oriented Curriculum By integrating literacy, communication, and mathematics into a single instructional model, the study provides insights into how ethnomathematical principles can be incorporated into traditional education systems to design a more inclusive and culturally responsive curriculum for the future.
Word problems in mathematics education: A survey	Verschaffel, Schukajlow, Star, & Van Dooren (2020)	The survey is congruent with ethnomathematics in that it responds to contextualization of word problems in mathematics and their cultural appropriateness. Ethnomathematics advocates for incorporating students' cultural backgrounds into mathematics teaching, making problems contextually relevant and meaningful.

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
		The study's findings indicate that conventional word problems lack authenticity in real-world scenarios, which ethnomathematical methods address by integrating local knowledge, cultural practices, and indigenous problem-solving approaches into the curriculum. Under the theme of "Ethnomathematics and the Curriculum of Tomorrow," this research affirms: ▪ Culturally Responsive Teaching ▪ Cognitive and Social Learning ▪ Closing the Gap Between Formal and Informal Mathematics ▪ Curriculum Innovation Therefore, this study adopts the main tenets of ethnomathematics by advocating for more context-based, meaningful problem-solving methods that resonate with students' everyday experiences.
Breaking the habit: Engineering students' understanding of mathematical creativity	Catarino, Nascimento, Morais, Campos, & Vasco (2019)	This study is pertinent to the ethnomathematics debate and curriculum development in the future in a number of ways: o Redefining Mathematical Creativity o Bridging Academic and Cultural Mathematical Knowledge o Inclusive and Progressive Pedagogies o Curriculum Innovation Therefore, Catarino *et al*. (2019) contribution provides insights into the potential of promoting mathematical creativity in learning, aligning with ethnomathematics' vision for a curriculum that embraces diverse mathematical conceptions and applications.
History of mathematics in mathematics education: Recent developments in the field	Chorlay, Clark, & Tzanakis (2022)	This research is closely aligned with the principles of ethnomathematics, as it focuses on the culture and history of mathematics in education. By incorporating historical accounts into the curriculum, teachers can encourage a more inclusive and contextual mathematical experience, as ethnomathematics does by acknowledging various mathematical practices in different cultures. - Cultural and Historical Contexts - Mathematical Understanding through Context - Pedagogical Implications - Bridging Traditional and Modern Mathematics

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
History of Mathematics Education in Brazil: An overview of view of secondary education	Gomes & Garnica (2021)	This study is applicable to the ethnomathematics discussion and curriculum planning for the future because: • Historical Context for Curriculum Reform • Integration of Local Knowledge • Colonial and Post-Colonial Influences • Pathway for Inclusive Education
Toward an anthropology of mathematizing	Marchand (2018)	This investigation is extremely pertinent to the debate surrounding ethnomathematics and the prospect of future educational curricula. Ethnomathematics explores the relationship between mathematics and culture, acknowledging that mathematical activities are profound elements of cultural contexts. By illustrating how mathematical knowledge can emerge from practical and cultural activities, Marchand's research reinforces the inclusion of ethnomathematical thinking within educational frameworks. This integration can make math education more inclusive and representative of diverse cultural practices, thereby enriching students' learning experience and appreciation of math as a human activity
Mathematics teacher educators learn from dilemmas and tensions in teaching about/through culturally relevant pedagogy	Nolan & Keazer (2021)	This study falls under the framework of Ethnomathematics and the Curriculum of Tomorrow's themes, emphasizing mathematics education that is responsive, culturally pertinent, and inclusive for learners of diverse backgrounds. The points of application are: ○ Bridging Ethnomathematics and Teacher Preparation ○ Decolonizing and Diversifying Mathematics Education ○ Critical Reflection and Praxis in Mathematics Teaching ○ Implications for Curriculum Design and Policy

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
Research trend mathematics problem solving in primary school: A bibliometric analysis using VOSviewer	Zahrah, Turmudi, Prabawanto, & Febriani (2024)	This study applies to ethnomathematics since it describes problem-solving practices that can be supplemented with cultural and contextual means. Educators can apply the knowledge of prevalent trends in research on mathematics problem-solving to include ethnomathematical approaches in curriculum design, so that varied cultural systems of knowledge are respected and implemented in mathematical teaching. This serves the vision of an inclusive, forward-looking curriculum that respects learners' culture.
Pedagogical innovations in elementary mathematics instructions: Future learning and research directions	Rahmadi & Lavicza (2021)	This research conforms to the ethnomathematical vision of promoting new teaching methods that are inclusive of multiple cultural outlooks and learning styles. Blending of technology tools and adaptive pedagogies harmonizes with the ethnomathematical paradigm, which emphasizes situated, culturally relevant teaching. In undertaking future directions for learning, the research accords with a reformist curriculum that promotes inclusivity and respects mathematics practices of various cultural communities so that the conversation of ethnomathematics within modern education is enhanced.
Culturally responsive mathematics teaching: A research synthesis	Abdulrahim & Orosco (2020)	This study closely follows the works of Ethnomathematics and the Curriculum of Tomorrow, which stress the need to incorporate cultural views into mathematics teaching. Ethnomathematics supports the acknowledgment of various mathematical practices within various cultures, which aligns with CRMT's vision of making mathematics more inclusive and meaningful to students' everyday lives. Through an emphasis on culturally responsive pedagogies, this research contributes to creating a progressive curriculum that is receptive to diverse mathematical worldviews, inclusive, equitable, and respectful of mathematical knowledge beyond Western paradigms.
The situated role of technology in enhancing the academic performance of indigenous students in	Lakhan & Laxman (2018)	This study is significant because it discusses the schooling inequalities experienced by Indigenous learners in mathematics education. Placing technology in a Māori cultural context, the study adds to the emergent literature on culturally responsive teaching and learning with technology as well as digital inclusion.

Research Title	Authors	Relevance to "Ethnomathematics and the Curriculum of Tomorrow"
mathematics learning: Application within a Maori cultural context in New Zealand		The research offers educators, policymakers, and curriculum designers' knowledge on how technology can be used to facilitate Indigenous learners' mathematical knowledge, participation, and performance. The results also have wider implications for the integration of technology into Indigenous education systems globally, enhancing equity and inclusivity in STEM education.
The role of mathematics in interdisciplinary STEM education	Maass, Geiger, Ariza, & Goos (2019)	This research's implications for ethnomathematics and future curricula are as follows: ▪ Interdisciplinary and Contextual Learning ▪ Mathematics as a Unifying Framework ▪ Real-World Applications and Cultural Relevance ▪ Equity and Inclusion within STEM ▪ Pedagogical Innovations
Sundanese ethnomathematics learning in improving mathematical literacy ability of elementary school students	Mufidah & Karso (2020)	This research fits into the wider agenda of ethnomathematics in informing future curricula through the illustration of how indigenous mathematics can enrich student learning. Through the inclusion of cultural knowledge in mathematics education, the research points to: o Cultural Relevance in Learning o Strengthening Mathematical Literacy o A Paradigm for Emerging Curricula o Bridging Traditional Knowledge and Modern Education
Trends and challenges of mathematics education in Mozambique (1975-2016)	Bussotti & Bussotti (2017)	Significant links to ethnomathematics and prospective curricula are: • Decolonization of Mathematics Education • Challenges of Curriculum Reform • Teacher Training and Integration of Local Knowledge • Closing the Gap between Traditional and Contemporary Mathematical Knowledge
Integrating local wisdoms for improving students' mathematical literacy: The promising context in learning whole numbers	Leton, Lakapu, Dosinaeng, & Fitriani (2025)	The study highlights how local wisdom can strengthen whole-number learning by connecting mathematics to students' lived experiences. It aligns with ethnomathematics by validating cultural knowledge as a meaningful source for mathematical understanding. Embedding whole-number concepts in real cultural practices helps bridge abstract ideas with familiar contexts. This approach supports curriculum development that is culturally relevant, contextualized, and literacy-oriented.

Ethnomathematics Integration Framework Development

A framework for ethnomathematics integration is proposed based on the case studies and theoretical foundations (Figure 2). The framework consists of:

1) Identification of cultural mathematical practices relevant to students' backgrounds.
2) Curriculum adaptation to include ethnomathematical content in alignment with educational standards.
3) Teacher training and professional development to equip educators with the necessary knowledge and skills.
4) Assessment strategies that evaluate both mathematical understanding and cultural appreciation.
5) Community involvement to bridge traditional knowledge systems with formal education.

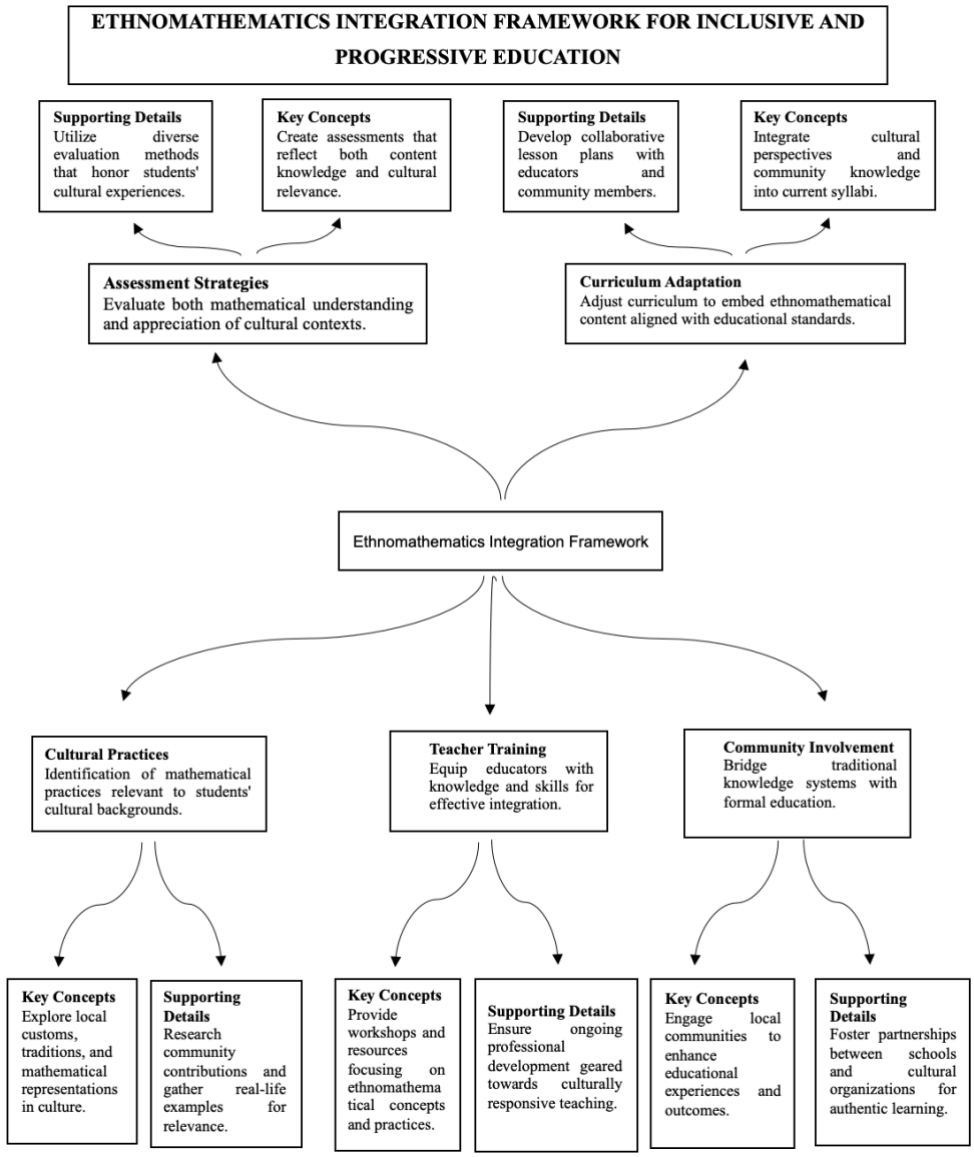

Figure 2. Ethnomathematics integration framework

Implementation Considerations

Successful implementation of ethnomathematics in curricula requires addressing:

a) **Institutional support**: Incorporating ethnomathematics in curricula depends on strong institutional support in terms of policies supporting culturally inclusive education. Education departments, schools, and policymakers have to recognize the significance of incorporating various mathematical knowledge systems in the mainstream curriculum. Through policy-making that accepts ethnomathematics as a viable method of teaching and learning, institutions can provide an education-friendly environment where cultural diversity is promoted in mathematics education (Rosa & Orey, 2013).

b) **Resource development**: One of the most important aspects of ethnomathematics implementation is the production of teaching materials that are based on cultural mathematical content. Producing culturally responsive teaching materials with embedded mathematical concepts from a variety of traditions can deepen students' mathematical understanding and appreciation (D'Ambrosio, 2001). These resources may come in the form of textbooks, digital media, hands-on activities, or real-world applications that show mathematics in a contextually meaningful way.

c) **Teacher training**: For ethnomathematics to be successfully integrated into the classroom, teachers also need training. Workshops, collaborative learning activities, and ongoing professional development can assist teachers in embracing culturally responsive pedagogical practices.

d) **Student engagement**: If students perceive the relationship of mathematics with their own culture, they gain greater appreciation for mathematics and become more motivated to learn (Barton, 1996). Tasks like ethnomathematical projects, storytelling, and hands-on investigations of classical mathematical practices can help to create an inclusive learning culture that appreciates diverse views.

e) **Assessment methods**: In order to effectively appreciate the embedded mathematics knowledge in various cultural practices, new assessment practices need to be formulated. Project assessments, portfolio assessments, and performance tasks can lead to a broader depiction of the mathematical capabilities of students (Nasir, Hand, & Taylor, 2008). These methods guarantee that students from diverse backgrounds are evaluated in a manner that captures their strengths and the different ways they use mathematical ideas.

f) **Highlighting Indigenous and Marginalized Knowledge Systems**: Underrepresented groups, such as Indigenous, rural, and historically marginalized communities, have deep mathematical knowledge systems that have been developed over centuries. For instance, Indigenous navigation methods, weaving designs, and building designs hold intricate mathematical concepts that are not always recognized in formal schooling (Gerdes, 1998). Students achieve a more holistic and culturally responsive concept of mathematics by integrating these knowledge systems into general education.

Future Directions

Future research should explore:

(1) The impact of ethnomathematics on students' mathematical performance.
(2) Longitudinal studies on the effectiveness of ethnomathematics in different educational contexts.
(3) Technological tools for teaching ethnomathematics, such as virtual reality simulations of cultural practices.
(4) Policy recommendations for nationwide adoption of ethnomathematics in curricula.

CONCLUSION

Ethnomathematics provides an inclusive and culturally appropriate approach to math education. Traditional mathematics training frequently depends on abstract, Eurocentric concepts that many pupils find detached from their cultural experiences. Integrating ethnomathematical principles into the curriculum allows teachers to promote engagement, deepen learning, and validate multiple mathematical knowledge systems (D'Ambrosio, 2001). This technique not only enhances learning but also promotes cultural identity and respect for underrepresented communities.

According to research, when students study mathematics using familiar cultural activities like weaving patterns, Indigenous navigation, or local architecture, they increase motivation, enhance problem-solving skills, and recall knowledge more efficiently (Nasir *et al*., 2008). Ethnomathematical teaching makes abstract concepts more understandable and promotes a sense of belonging. Longitudinal study emphasizes its potential long-term benefits, including as cognitive growth, job options, and good attitudes toward mathematics (Gerdes, 1998).

Finally, ethnomathematics is more than a teaching method; it is a movement to recognize the various mathematical traditions that have shaped human history. A organized framework for incorporating ethnomathematics can improve mathematics education's equity and global awareness. Using this strategy, instructors may empower students, overcome cultural boundaries, and encourage both academic success and cultural appreciation.

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